Kansas State University

PITTMAN BUILDING
WALK-IN FREEZER RENOVATION PROGRAM
A-013020

February 2016

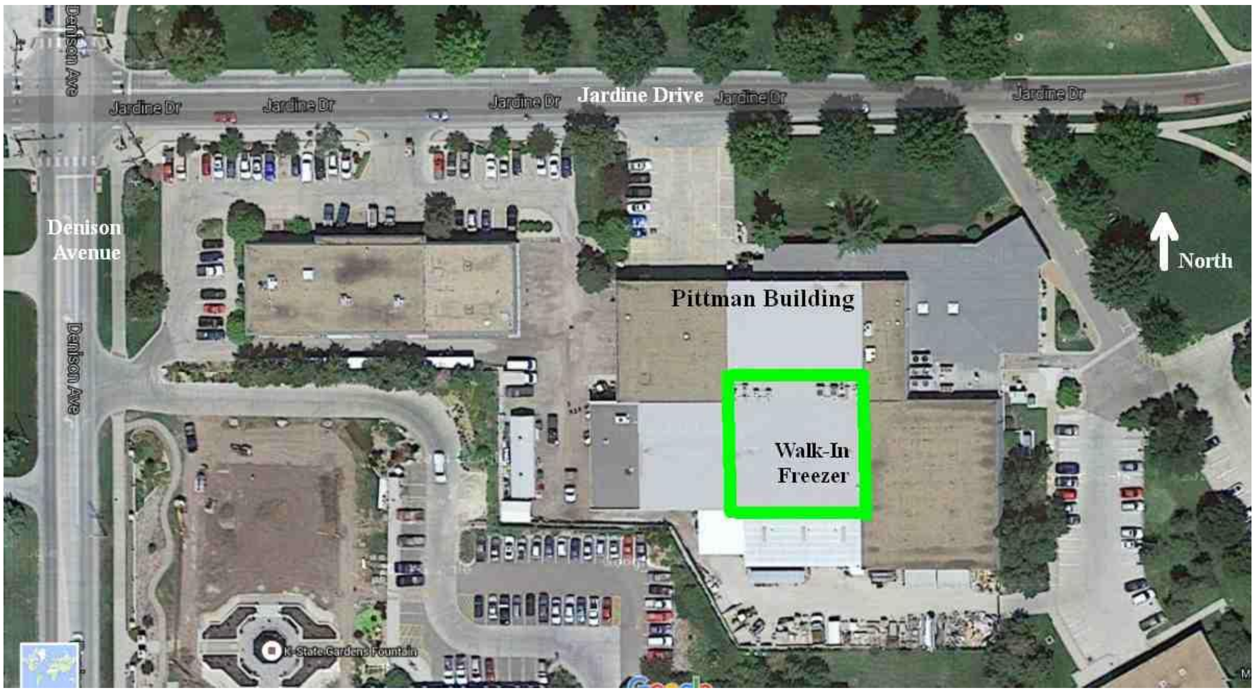
Prepared by:

K-State Facilities Campus Planning and Project Management
K-State Department of Housing & Dining Services
Includes Report Prepared by Bartlett & West Engineers

Introduction

The Pittman Building provides the administrative offices and food storage for the K-State Department of Housing and Dining Services (HDS). HDS is a self-operated auxiliary department that provides housing and dining for approximately 5,500 students. The dining operation offers three dining centers, a restaurant, bakery, coffee shop and three convenience stores. The award-winning dining program serves meals from scratch seven days a week.

Site Map



Pittman Building Aerial View

Project Description

The Pittman Building was constructed in 1967. In addition to administrative offices, it serves as the HDS central food storage and distribution facility. A major component of the food storage is a 10,000 square feet walk-in freezer. This nearly 50 year old freezer facility must now be renovated to replace inefficient equipment, replace roofing and insulation, and upgrade life-safety features. The complete report on the walk-in freezer is attached to this program and lays out the options and improvements recommended.

Current Conditions & Space Summaries

The Bartlett & West study identified several components needed to improve the energy efficiency, maintenance, and life safety features. Due to budget constraints not all options are recommended. The primary components that are recommended include:

1. Replace roof and insulation system,
2. Provide ventilation for wall system,
3. Replace lighting,
4. Replace refrigeration equipment
5. Replace sliding doors,
6. Provide exit doors, exit lights and paths,
7. Provide fire alarm horns and strobes and,
8. Provide smoke detectors.

Space Projection / Summaries

Floor Level		
Name of Space	**Size of Space**	
Walk-In Freezer	10,000	**SF**
Total	**10,000**	**SF**

Budget

Estimate of Project Costs	
Design Fees	
(Architect, Engineer, other Specialty Consultants also includes Building Commissioning)	$162,000
Construction (Building and Site Development)	
GSF = 10,000 Cost per GSF = $162	$1,620,000
Ancillary Contracts	
(Site Survey, Geotechnical Investigation, Construction Testing, etc)	$20,000
FF&E	
(Furniture, Audio Visual, IT (data and Phone), specialty equipment, etc.)	$33,000
Miscellaneous Costs	
(Administrative fees, Internal Labor, Security and Locks, Landscaping, Project Contingency)	$185,000
Total	$2,020,000

Funding

The project will be funded with K-State Housing and Dining auxiliary funds.

Maintenance

This project only includes renovation of existing spaces and with no changes in function. New refrigeration equipment and insulation qualities will be improved providing significant operating costs savings. Maintenance and operation costs will continue by Housing & Dining Services.

Timeline/Schedule

AE Selection	April 2016
Design	June – September 2016
Bid	November 2016
Construction	April – July 2017
Occupancy	July 2017

Walk-In Freezer Assessment

For

Kansas State University

Division of Facilities Management

At

Pittman Building

Manhattan, Kansas

January 11, 2016

Bartlett & West

Service. The Bartlett & West Way.

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Executive Summary

Bartlett & West was contacted by Mark Taussig, Project Manager for KSU Campus Planning; Skyler Harper, KSU Department of Housing & Dining and Kerry Jennings, KSU Department of Housing & Dining, and requested to assess the conditions of an existing 10,000 SF walk-in freezer located in the Pittman Building on the KSU campus. The primary concern with the freezer is that moisture is penetrating the roof of the building/freezer and creating very large ice formations within the freezer. The building and freezer were originally constructed in 1967. The only noticeable change to the original construction is the additional roof installed over the top of the existing flat roof. KSU staff also discussed the need for an assessment with Tom Pospisil, Cold Storage Engineering & Technologies, Inc. Tom has conducted some limited review of this freezer installation in the past and has some limited history with the installation of this freezer having worked with the company which provided this particular freezer during the later stages of its installation. Other consultants included on the assessment team include: Mike Mayo (architect), The Ebert Mayo Design Group; Celeste Spickert (structural engineer), Bartlett & West, Inc.; and Bill Naeger (MEP engineer), Bartlett & West, Inc.

The existing walk-in freezer construction and systems installed in 1967, and have been in place for nearly 50 years with minimal alterations or additions. As a whole the construction looks in reasonably good condition. However the evidence of moisture in the roof is apparent. The ice formations would indicate that the roof insulation system is saturated. A similar condition likely occurs in the wall and floor insulation systems, even though there are no means to visually determine this assumption without selective demolition occurring. The replacement of the insulated panels present additional challenges in that the method of construction is such that the plywood sheathing which is functioning as the roof and wall diaphragms must be removed in order to replace the insulated panels. To further complicate this task, this sort of composite construction has not be tested and rated as a lateral diaphragm for structural purposes. These factors make replacement of the insulated panels more involved and more costly because of structural improvements which are also required.

Another aspect which increases the complexity of any repairs or replacement of the insulated panels is that the building codes have changed dramatically over the nearly 50 years since the construction of this walk-in freezer. The replacement of the saturated roof panels triggers some Code related improvements such as the installation of a sloped roof, fire protection sprinkler system (or engineered alternative), emergency lighting and emergency exits. All of these items make a costly repair project more involved and more costly.

As a minimum the facility needs to have the roof insulation system replaced in order to reestablish a dry insulated barrier at the roof. The work required to accomplish this is included in Options 1A, 1B and 1C. While the most economical option to address this issue is Option 1B. However, the single slope option presented in Option 1C provides a better long term solution with fewer maintenance concerns. Additional items which will need to be addressed with Option 1C due to Code requirements include: upgrade lighting and emergency lighting (Option 4), add fire alarm horns/strobe (Option 5), provide smoke detection as an engineered alternative to a fire protection sprinkler system (Option 6) and provide new exit man-doors with exit lights and egress path floor markings to meet exiting requirements (Option 10). Additional options included in the recommendations include: provide ventilation system for wall system (Option 3), replace refrigeration systems (Option 8 or 9) and replace sliding doors (Option 11).

Option 3 is recommended since complete replacement of the wall systems was determined to be cost prohibitive, yet the existing moisture in the wall needs to be addressed to limit mold growth. The wall ventilation system accomplishes this need. The replacement of the refrigeration systems and the sliding doors are recommended due to the age of these systems, the inefficiencies of the systems and the reliance on refrigerants and components which are obsolete and very challenging to purchase when addressing repairs. The total estimated project costs for all of these options is $1,427,000.00 –
$1,616,000.00.

While it is suspected that the wall and floor insulation is also saturated and providing very little insulation value the cost to replace the wall construction, the finished concrete floor and the insulation is very costly at $182,000.00 - $204,000.00 (Option 2) and $336,000.00 - $358,000.00 (Option 6) with very limited energy savings.

Discussion

General

The existing freezer dimensions are 111′ (L) x 90′ (W) x 16′ (H), with the ceiling and wall enclosure comprised of modular sectional insulated panels manufactured by Bally Case and Cooler, Inc. of Bally, Pennsylvania in 1967. Bally was the first modular panel manufacturer in the industry to utilize polyurethane insulation, and early application design was utilized for this facility. The panels are composed of 24 gauge galvanized steel facing interior and exterior with a core of polyurethane insulation having an initial heat transfer rating of 0.118 "K" factor. Wall panel thickness is 4" (R34 new), and ceiling panel thickness is 3 5/8" (R30 new). The panels are structurally connected by a cam-hook action locking mechanism, with the cam pockets connected by a 2" wide, 24 gauge steel metal strap, centered in the depth of the panel, and continuous through the width of the panel. Nationally recognized tests for structural or fire capability were not performed on the insulated panels at the time of manufacture, and the foam components utilized did not have fire retardant materials added to the mixture (manufactured prior to required ratings). The enclosure is adjoining the remainder of the building separated with a concrete block wall extending 72′ on the west side from the northwest corner, and extending the full freezer width on the north end (except at the freezer door opening).

The enclosure is supported by a solid member structural framework, with spacing of the support spans at 9′-7", and with the panel manufacturer's proprietary channel and anchor clamp assemblies 2′ in length perpendicular to the structural support, reducing the ceiling panel net span to 7′-7". Intermediate height and top of wall structural connections do not exist to transfer shear loads to the structural system, instead relying on the wall panel to ceiling panel connection with transfer to the ceiling structure diaphragm for lateral loading. The structural system does not include any type of cross bracing between columns for shear loading, nor does the roof structural include cross bracing for diaphragm loads.

The freezer floor design is an insulated concrete "sandwich" type, with 4″ of polyurethane insulation between a base slab of 4″ concrete and a top reinforced wearing slab of 4″ concrete. A "moisture barrier" is applied below the base slab, below the insulation, and below the wearing slab (triple barrier). A 2″ perimeter "thermal break" up to the bottom center of the wall panel completes the room insulated envelope. Heat loss below the insulated floor is replaced by a roof mounted forced ambient air ventilation system ducted to a sub-floor plenum pipe laid the length of the freezer on the west side, joined to lateral 6″ vent pipe laid the width of the freezer running west to east on nominal 6′ centers, exhausting through the east foundation wall on the opposite side of the freezer. The ventilation pipe is a nominal 18″ below the sub-slab on the west side, and pitches down to the east side for drainage. The above grade exposed foundation wall is not insulated on the south and east sides.

Roof Construction

The weather roof over the freezer consists of the original built-up roofing with an added second layer of built-up roofing. The built-up roof is applied directly to a plywood sheathing resting on 2 x 4 blocking spaced at 23″, which are mechanically fastened to the insulated ceiling panels. The air space created by the blocking does not have a forced air ventilation system, but has two rows of free flow ventilators spaced on nominal 30′ centers.

There are several concerns with the existing roof system. The most noticeable concern is the moisture penetration which has created large ice formations from the ceiling inside the walk-in freezer. Contributing factors for this moisture include the flat roof, roofing material which does not provide a true vapor barrier and the air space created by the wood blocking which is inadequately ventilated. The evidence of moisture in the roof assembly indicates that the panel insulation is saturated and has a reduction of heat transfer through the assembly. The adoption of Building Codes and the advancement of the Codes over the nearly 50 years since this facility was constructed presents other considerations which include that flat roofs are not an acceptable building practice by the current Codes and the current roof assembly is not a tested and rated construction assembly. Since this assembly is not rated, any replacement of a portion or all of the assembly requires the replacement assembly to meet the current Building Code requirements for a rated assembly or the addition of elements to the structural steel to accommodate these same requirements.

Wall Construction

The wall construction consists of two different assemblies. The east and south walls are constructed of an exterior corrugated metal panel, wood framing and the walk-in insulation panel. The west wall is constructed of 8″ CMU, a small air space and the walk-in insulation panel. The north wall has portions which are each of these two wall assembly constructions.

The west wall is shared with a dry storage room maintained at cooler temperatures. There are signs of mold at the base of the wall in the dry storage area due to the occurrence of condensation between the masonry and the insulated panels, then collecting at the bottom of the wall cavity.

The primary concerns with the existing wall systems include the noticeable moisture at the west wall and a similar situation as the roof in that the manner in which the east and south walls are constructed is not a tested and rated construction assembly according to the current Building Codes. While the only current visual signs of moisture are at the west wall, it is reasonable to expect that similar conditions exists at the east and north wall, but the moisture is evaporating due to the difference in construction.

Like the roof insulation panels, it is likely that the wall insulation panels are also saturated which reduces the insulation capacity of the panels. Similar to the situation with the roof, if the wall panels are replaced, other portions of the east, south and north wall assemblies will also have to be replaced. This will require wall improvements to meet the requirements of the current Building Code requirements for vertical and lateral load conditions. Included with the replacement of the wall insulation panels, a warm air ventilation system can be provided to eliminate the opportunity for condensation, moisture accumulation, and mold growth.

Floor Construction

The floor construction consists of a 4″ concrete subfloor with 4″ of insulation and a 4″ concrete finish floor inside the walk-in freezer. There are no visual signs of failure or need of repair to the floor system. It is suspected that the insulation is saturated, but no selective demolition was conducted to determine for certain.

The existing floor construction is in good condition. Replacement of the floor insulation can increase the operating efficiency of the refrigeration equipment by decreasing the heat gain from the earth below the floor. However, the cost to remove the existing finish floor and insulation, and replace these items is costly with little energy savings. The estimated energy savings is 0.120 MMBtu. At an estimated energy cost of $11-$12/MMBtu, the simple payback of the floor replacement in excess of 100 years.

Refrigeration Systems

The existing refrigeration systems consists of two indoor compressor units located in a common equipment room with an air handling unit, gas boiler, gas water heater and electrical equipment. The compressor units utilize R-502 refrigerant and are paired with two outdoor condenser units located on the roof of the mechanical room. Each compressor/condensing unit serves (4) evaporator fan coil units in the walk-in freezer.

The existing refrigeration systems have operated well beyond the typical life expectancy of 15-20 years and utilize a refrigerant (R-502) which was phased out of production in 1995.

New refrigeration systems can provide more efficient operating systems as well as utilize currently manufactured refrigerants which are more environmentally friendly. The costs for out of production refrigerants become increasingly more costly as reclaimed quantities diminish. Replacement of the refrigeration systems trigger additional issues, with the most significant impact is that current Codes require dedicated refrigeration machinery rooms for this type of equipment. This means that any new refrigeration equipment cannot be located in the existing mechanical room which also houses an air handling unit and other equipment. The purpose for this separation is to avoid any refrigerant leak releasing harmful gases into air handling units and distributing these gases to other occupied portions of the building, exposing potentially flammable gases to the open flame present in boilers and water heaters, and to allow any refrigerant gas release to be contained, detected and safely removed from potentially occupied spaces quickly and safely.

There are two options available to replace the existing refrigeration system. The first is to provide a new central refrigeration system with multiple compressors, outdoor condensers and multiple evaporator fan coil units. This system can be arranged to provide redundancy to minimize effects on the freezer operation. This centralized system will require a new refrigerant machinery room to be constructed either within the existing building limits or added on to the existing building. The construction of this machinery room would also require mechanical and electrical systems to support this equipment operation. The second option is to provide a new decentralized refrigeration system. This system would consist of evaporator fan coil units in the freezer(s) which would be paired with dedicated compressor/condensing units. The compressor/condensing units would be located either on the ground or the roof outdoors. This system arrangement can include redundant equipment such that the loss of a single unit would not put the freezer operations at risk. The decentralized system would also not require the construction of a new refrigerant machinery equipment room. The decentralized system initial cost is less than the centralized system.

Ancillary Systems

The existing lighting systems in the walk-in are surface mounted fluorescent fixtures. There are existing fire alarm horns mounted on the perimeter walls, but there are no visual alarm (strobe) units installed in the walk-in. There is no fire protection sprinkler system in the walk-in freezer or in the building.

While the existing lighting fixtures provide an adequate amount of illumination, it would be reasonable to consider an upgrade to provide more efficient LED lighting fixtures with better illumination. Occupancy sensors could also be provided to provide additional energy savings during unoccupied periods. Additional emergency lighting systems would not be necessary since the entire building is served by an emergency generator. Life Safety Code will also require exit lights indicating the existing and new exit doors. Other Code requirements dictate that the fire alarm notification devices shall provide an audible alarm at a designated sound level above ambient sound level and visual alarm (strobe) units must provide adequate coverage in the space. Additional devices can be added to the existing alarm units to satisfy these requirements. The requirement for a fire protection sprinkler system is a requirement of the Building Codes since the time that this facility was originally constructed. The magnitude of work involved with the replacement of the roof system may trigger a requirement to bring the walk-in up to current Codes. One of the most significant requirements is that of a fire protection sprinkler system. There are numerous challenges involved with the installation of a fire protection sprinkler system. Those challenges include: the determination of an acceptable installation method due to the low ambient temperatures of the freezer space, the building construction and the high construction costs. After review with the AHJ and State Fire Marshal, it was determined that full coverage smoke detection would be considered as an engineered alternative to a fire protection sprinkler system in the freezer.

Access and Exits

One 7′ (W) x 8′ (H) bi-parting horizontal slide, electric operated freezer door with 4″ thick door panels is the only access to the walk-in freezer. A single access (exit) point controlled by electricity presents a significant concern for personnel safety within the walk-in. Current building and safety codes require multiple exits with panic hardware to allow operation from the inside without keys or electrical power. The number of exits could vary based upon interpretations by the local Authority Having Jurisdiction (AHJ) and travel distance to the exits, but the addition of these exits are imperative to provide an acceptable level of life safety to the occupants entering the walk-in. These exits would be typical man-size doors rather than large doors to allow product movement and are required to include panic hardware to ensure easy exiting without the need for keys while still maintaining security from unauthorized entry from the exterior. The number of new exit doors would be determined by the exit path lengths and coordination with the AHJ. It is likely that two exit doors connecting to the outdoors or existing exit paths in the existing building will be sufficient. Egress paths will be required to clarify paths which must be maintained clear and assist in direction of traffic to exit doors.

Options for Consideration

Several options are presented to address the issues and concerns discussed in the Discussion section of this report. Each option is described and an estimated costs to implement the option is provided for use in establishing project budgets for options selected for implementation.

Option 1A: Replace the existing roof and roof insulation system in order to address the leaks. The replacement roof consists of a typical metal roof deck with sloped R-50 roof insulation and roof membrane. This option includes:

a. Removal and replacement of the existing insulated roof panel system. The removal of the existing roof system of insulated panels and plywood sheathing eliminates any certifiable roof diaphragm required by Code to assure building stability. Building Code will also require any replacement roof to be sloped rather than flat as currently exists. A new sloped saw-tooth roof will require some modifications to the existing wall panel system and structure to accommodate the sloped conditions.

b. Insulated wall modifications to accommodate new sloped roof system.
c. New sloped saw-tooth roof system with membrane (vapor barrier).
d. Wall modifications to accommodate new sloped roof system.
e. Structural reinforcements/modifications to provide adequate roof diaphragm and accommodate new sloped saw-tooth roof.

Estimate of probable construction costs:	$750,000.00 - $770,000.00
Estimate of professional design consultant services:	$ 75,000.00 - $ 80,000.00
Total estimated costs to implement Option:	$825,000.00 - $850,000.00

Option 1B: Replace the existing roof and roof insulation system in order to address the leaks. The replacement roof consists of an insulated roof panel system and roof membrane. This option includes:
a. Removal and replacement of the existing insulated roof panel system. The removal of the existing roof system of insulated panels and plywood sheathing eliminates any certifiable roof diaphragm required by Code to assure building stability. Building Code will also require any replacement roof to be sloped rather than flat as currently exists. A new sloped saw-tooth roof will require some modifications to the existing wall panel system and structure to accommodate the sloped conditions.
b. Insulated wall modifications to accommodate new sloped roof system.
c. New sloped saw-tooth roof system with membrane (vapor barrier).
d. Wall modifications to accommodate new sloped roof system.
e. Structural reinforcements/modifications to provide adequate roof diaphragm and accommodate new sloped saw-tooth roof.

Estimate of probable construction costs:	$530,000.00 - $550,000.00
Estimate of professional design consultant services:	$ 53,000.00 - $ 55,000.00
Total estimated costs to implement Option:	$583,000.00 - $605,000.00

Option 1C: Replace the existing roof and roof insulation system in order to address the leaks. The replacement roof consists of an insulated roof panel system and roof membrane. This option includes:
a. Removal and replacement of the existing insulated roof panel system. The removal of the existing roof system of insulated panels and plywood sheathing eliminates any certifiable roof diaphragm required by Code to assure building stability. Building Code will also require any replacement roof to be sloped rather than flat as currently exists. A new one-way sloped roof will require some modifications to the existing wall panel system and structure to accommodate the sloped conditions.
b. Insulated wall modifications to accommodate new sloped roof system.
c. New one-way sloped roof system with membrane (vapor barrier).
d. Wall modifications to accommodate new sloped roof system.
e. Structural reinforcements/modifications to provide adequate roof diaphragm and accommodate new one-way sloped roof.

Estimate of probable construction costs:	$570,000.00 - $590,000.00

Estimate of professional design consultant services:	\$ 57,000.00 - \$ 59,000.00
Total estimated costs to implement Option:	\$627,000.00 - \$649,000.00

Option 2: Replace the existing wall insulation system. This option includes:

a. Remove and replace the existing insulated wall panel system.

b. Provide structural reinforcements/modifications to support new wall panels.

Estimate of probable construction costs:	\$165,000.00 - \$185,000.00
Estimate of professional design consultant services:	\$ 17,000.00 - \$ 19,000.00
Total estimated costs to implement Option:	\$182,000.00 - \$204,000.00

Option 3: Provide new forced ventilation system in existing or new wall insulation system. This option includes:

a. Provide wall modifications to west wall to accommodate new forced ventilation system.

b. Provide forced ventilation system to serve space created in west wall construction.

Estimate of probable construction costs:	\$ 37,000.00 - \$ 42,000.00
Estimate of professional design consultant services:	\$ 4,000.00 - \$ 5,000.00
Total estimated costs to implement Option:	\$ 41,000.00 - \$ 47,000.00

Option 4: Replace existing lighting fixtures in order to meet current illumination standards. Provide new emergency and exit lighting throughout freezer.

Estimate of probable construction costs:	\$ 90,000.00 - \$ 95,000.00
Estimate of professional design consultant services:	\$ 9,000.00 - \$ 10,000.00
Total estimated costs to implement Option:	\$ 99,000.00 - \$105,000.00

Option 5: Provide additional fire alarm horns and strobes in freezer.

Estimate of probable construction costs:	\$ 9,000.00 - \$ 10,000.00
Estimate of professional design consultant services:	\$ 1,000.00 - \$ 1,000.00
Total estimated costs to implement Option:	\$ 10,000.00 - \$ 11,000.00

Option 6: Provide new smoke detection system to provide full coverage in walk-in freezer as an engineered alternative to a fire protection sprinkler system.

a. Provide new beam detection or VESDA style smoke detection system suitable for operation in low operating temperature.

Estimate of probable construction costs:	\$ 30,000.00 - \$ 35,000.00
Estimate of professional design consultant services:	\$ 3,000.00 - \$ 4,000.00
Total estimated costs to implement Option:	\$ 33,000.00 - \$ 39,000.00

Option 7: Replace floor insulation system due to expected saturation condition. This option includes:

a. Remove and replace existing floor insulation system.
b. Remove and replace existing forced ventilation system with heated system.
c. Existing underfloor ventilation duct system to remain

Estimate of probable construction costs:	$305,000.00 - $325,000.00
Estimate of professional design consultant services:	$ 31,000.00 - $ 33,000.00
Total estimated costs to implement Option:	$336,000.00 - $358,000.00

Option 8: Replace existing central plant refrigeration equipment with new central plant refrigeration equipment, new evaporator coils and piping. This option includes:
a. Remove and replace refrigeration systems.
b. Construct new refrigeration machinery room as an addition to the building.
c. MEP systems for new machinery room addition.

Estimate of probable construction costs:	$530,000.00 - $550,000.00
Estimate of professional design consultant services:	$ 53,000.00 - $ 55,000.00
Total estimated costs to implement Option:	$583,000.00 - $605,000.00

Option 9: Replace existing central plant refrigeration equipment with new decentralized refrigeration equipment (roof or ground mounted condensing units), new evaporator coils and piping. This option includes:
a. Remove and replace refrigeration systems.
b. Construct new concrete pads or roof supports for condensing units.
c. Electrical connections for new equipment.

Estimate of probable construction costs:	$435,000.00 - $455,000.00
Estimate of professional design consultant services:	$ 44,000.00 - $ 46,000.00
Total estimated costs to implement Option:	$479,000.00 - $501,000.00

Option 10: Provide new exit man-doors to provide two exits from the freezer. This option includes:
a. Provide (2) man-doors in existing insulated wall panels.
b. Provide vestibule at new doors adjacent to existing cool storage.
c. Provide steps from new door to grade for exiting.
d. Electrical modification to accommodate new exit doors.
e. Provide exit lights at exit doors and along egress path.
f. Provide painted egress paths on freezer floor.

Estimate of probable construction costs:	$ 85,000.00 - $ 95,000.00
Estimate of professional design consultant services:	$ 9,000.00 - $ 10,000.00
Total estimated costs to implement Option:	$ 94,000.00 - $105,000.00

Option 11: Replace existing sliding doors. This option includes:
a. Replace sliding doors
b. Electrical modification to accommodate new doors.

Estimate of probable construction costs:	\$ 40,000.00 - \$ 50,000.00
Estimate of professional design consultant services:	\$ 4,000.00 - \$ 5,000.00
Total estimated costs to implement Option:	\$ 44,000.00 - \$ 55,000.00

Conclusions and Recommendations

The major areas of concern to address in determining which options to implement include addressing the existing moisture penetrating the insulated panel system, life safety concerns and required Building Code upgrades.

The first improvements for consideration should address the initial concern of the moisture penetration which has led to discussions of additional issues. The two sources of moisture are through the roof system and in the wall systems, specifically noticeable at the shared west wall. The presence of moisture in both of these areas indicate that the roof and wall insulation systems are saturated. The two insulation systems should be considered for replacement. The replacement of the roof or wall insulation panels trigger several other options which are related because of the integration with the insulation panels or the upgrades to meet current Code requirements. The age of the walk-in insulation components and the mechanical systems serving the walk-in is also a consideration when determining the recommended improvements.

Operational considerations affect the recommendations as much as the physical considerations for the needs of the walk-in freezer. Without complete shutdown of the walk-in freezer all of these considerations suggest a multi-phased solution to address all of the concerns. A multi-phased approach can increase the cost and extend operation challenges. This report considers that the facility will be shut down and the product will be stored off site during the construction to address the improvements.

The recommended options to be implemented to provide a walk-in freezer suitable to serve KSU with an energy efficient and safe unit for years to come include:

Option 1C – Replace roof and roof insulation system:	\$ 627,000.00 - \$ 649,000.00
Option 3 – Provide ventilation system for wall system:	\$ 41,000.00 - \$ 47,000.00
Option 4 – Replace lighting systems:	\$ 99,000.00 - \$ 1 05,000.00
Option 5 – Provide fire alarm horns and strobes:	\$ 10,000.00 - \$ 11,000.00
Option 6 – Provide smoke detection system:	\$ 33,000.00 - \$ 39,000.00
Option 8 or 9 – Replace refrigeration systems:	\$ 479,000.00 - \$ 605,000.00
Option 10 – Provide exit doors, exit lights and paths:	\$ 94,000.00 - \$ 105,000.00
Option 11 – Replace sliding doors:	\$ 44,000.00 - \$ 55,000.00
Total estimated cost of recommended options:	\$1,427,000.00–\$1,616,000.00

Other options considered in lieu of implementing all of these options include the construction of a new walk-in enclosure inside the existing walk-in or construction of a new walk-in adjacent to the existing building.

The construction of a new walk-in within the existing enclosure was deemed not viable primarily due to the extreme challenges involved in the construction methods to implement this option. The first issue is that the existing structure is not adequate to support the additional insulation panels. Therefore a new structure would be required to support this option. It was determined that this sort of construction is not feasible. Additional ventilation systems would be required for the space between the roof panels of the new and existing systems, which would add cost to this consideration. For these reasons, this option was not evaluated further.

The option to construct a new walk-in adjacent to the existing facility requires all of the costs required to upgrade the existing walk-in, as well as additional costs. While some of the costs would be lessened due to new construction versus remodeled construction, the additional costs for building foundations and floor systems increase the costs for a new walk-in. The relocation of the walk-in also requires additional operational challenges due to distance and potential elevation differences. Due to these additions, this option was not evaluated further.

Options 2 and 7 to replace the wall and floor insulation and the finished floor system provides only minimal energy savings. Based upon this evaluation and the fact that the existing wall and floor systems is in very good structural condition, these options are not recommended.